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Antimicrobial Resistance

&

Anthropology

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1. Introduction

Antimicrobial resistance forces us to imagine a future without antimicrobial medicines. What would such a future be like? What hinges on these medicines? What can we do to both reduce likelihood of resistance emerging and also to build a future less reliant on these medicines?

Anthropologists have been studying medicines and the ways in which humans relate to them for the past century. Such work is informative for interpreting the role antimicrobials have in health and healthcare, looking at the range of places and spaces in which these medicines enable particular forms of life, social worlds and infrastructural arrangements. This can provide insights into how reliance on antimicrobials might be reduced and the potential consequences of doing so. Beyond the biological functions of medicines, anthropologists have examined how these objects take on other meanings and roles in different arenas. This body of work is instructive for interpreting how antimicrobials are used, prescribed, marketed and integrated into agendas from patients to prescribers to pharmaceutical companies to governments and global bodies. This can provide insights into the challenges faced by attempts to reduce or target medicine use, given their values beyond biological function.

Anthropological work can also contribute to how we understand changes and movement of microbes and their relations with humans. Classical anthropology sought to characterise all aspects of particular societies, which focused not only human kin relations, rituals and beliefs but encompassed relations with other species, incorporating rich descriptions of every-day life from sleeping arrangements to toilet practices, to food production and social gatherings. Such a holistic approach that sees life as produced by socio-material relations has provided insights into the emergence and spread of diseases and can be drawn from in understanding (what is termed as) antimicrobial resistance. Anthropological studies of the ways in which science is made is also informative for reflecting on our understanding of AMR as a problem. Following in the footsteps of anthropologists who have shed new light on the construction of scientific facts such as human reproduction, the formulation of AMR as a scientific subject can be reviewed in the light of the linguistic and relational accounts within science and policy. Such work would allow us to reconsider the ways we imagine AMR, and allow for the emergence of other possible ways to constructing the matter.

This brief will touch on some concepts that have been developed over the past few decades within anthropological work that may be helpful in thinking about antimicrobial medicines and antimicrobial resistance, with a focus on antibiotics. It will introduce these ways of (re)thinking alongside a narrative of these approaches over time, which raises questions for research, informed by anthropological work.

2. Antimicrobial magic

The story of antimicrobials has been interwoven with the triumphalist narrative of twentieth century science, specifically of medical men and medical science (Greenwood, 2008). The search for substances that could kill disease microbes without harming the host had perplexed scientists for decades before Fleming's encounter with the substance he called penicillin. German scientist and Nobel laureate Paul Ehrlich had termed such substances *Zauberkegel* (Ehrlich, 1913), or 'magic bullets', a metaphor that took hold and was to become used widely in reference to antimicrobials. Anthropologists find it useful to explore how metaphors are used, as a way to gain insight into how an idea or issue is framed. Through the lens of the magic bullet metaphor, our focus is drawn to the effectiveness rather than the effects of these magical substances. We can see that unwanted effects blur out of focus: they are 'side' effects, mundane and uninteresting in contrast with the magic of high efficacy. Augmenting this view, the notion of the 'right drug, at the right time, in the right dose' allows for the miracle of efficacy in conjunction with explanation for potential failure or ill-effects; the responsibility of the prescriber or patient rather than the drug. 'Adherence' and 'compliance' become key concepts for retaining the power of antimicrobials (Trostle, 1996). Whilst retaining their mystique and desire as powerful substances, the mass production of antimicrobials and possibilities they presented rapidly moved them into the fabric of lives and healthcare systems around the world (Podolsky, 2015).

2.1. Antimicrobials as essential

Antimicrobials were cast formally as *essential* to human health through their role in primary health care in the declaration signed by 134 countries from around the world at Alma Ata in 1978 (World Health Organisation & United Nations Children Fund, 1978). The push to open up access to these medicines at pace and scale came with the assumption that they would be universally applicable and desired. Experiences around the world of rejection or adaptation of these biomedical products from their supposed form and context prompted anthropological research. Such studies of medicines have engaged with how such substances may be accommodated in different settings as well as how medicines are bounded up with particular contexts (such as association with high tech biomedicine) which travel with them and add to their meaning.

Throughout the history of the sub-discipline, medical anthropology research has drawn attention to cultural, social, political and economic structures that shape the distribution of disease as well as access to biomedical treatment. In this line of research, anthropologists have recognised the importance of antimicrobials in alleviating suffering, and have worked (primarily in Low and Middle Income Countries (LMICs)) to understand how access to and use of essential medicines could be improved (Manderson, 1998).

2.1.1. Medicine characteristics

The Essential Medicines movement, championed by the World Health Organisation after its publication of the first essential medicines list in 1977, enlisted anthropologists into multi-disciplinary teams to identify ways to increase access to and rational use of medicines considered vital tools to improve and maintain health (World Health Organisation, 1985). With rational use defined by biomedical science, anthropologists provided evidence of consumers' own rationalities for use of medicines. These studies have shown for example how medicines were used to treat symptoms rather than a particular disease (Feierman, 1981); to self-medicate common or 'ordinary'

illnesses such as fever (Kamat, 2006); and to take medicines until symptoms have ceased (Nichter, 2008). Numerous studies also sought to characterise how people would identify medicines as particularly efficacious, or compatible. For example, colour, taste and appearance as well as form such as injection, intravenous fluid or oral tablets, could all indicate the efficacy, strength and tolerability of drugs (Whyte et al., 2002). These accounts have illustrated diversity in perceptions of particular medicine types or characteristics, both between and within settings. In many cases, medicine has been found to be a personal issue; what works for one person might not for the next, and different dosages, timings and ways of taking medicines would need to be experimented with on a case by case basis (Nichter, 2008). These findings often draw contrasts with international standardised guidelines, demonstrating a gap between local and global perspectives of what was 'appropriate', 'rational' and 'proper'.

Side effects of medicines have also come under study (Etkin, 1992). Again, the distinction has been drawn between effects considered 'side' in one context and of significance in another. Thus, anthropologists can explore how side effects can be considered important in negotiating 'appropriate' use of drugs, through the various ways they are interpreted as demonstrating: a drug is working (for example vomiting might be taken as a required sign of a drug taking effect), the strength of a drug (a drug without side effects may be considered less/in-effective), or that a drug disagreed with a particular body.

2.1.2. Beliefs

Beyond the focus on characteristics of medicines themselves, anthropologists have also highlighted their use in reference to local conceptualisations of causality of illness as well as locally correct modes of healing. This could be depicted through *explanatory models*, which describe cultural ideas about illness and were proposed in the 1970s as ways to understand and negotiate different perspectives of ill-health and misfortune (e.g. Kleinman et al., 1978). This would enable anthropologists to work with biomedical practitioners to bring together local aetiologies and priorities with biomedical knowledges and resources (e.g. Helman, 1984). Such models retain utility. For example, Mark Nichter's ethnographic work in the Philippines provides a rich description of preventive and protective antibiotic use by patrons of sex workers, who variously took antibiotics before sex, after sex, occasionally or routinely depending upon their own situations and familiarity with the particular sex worker (Nichter, 2001). His analysis demonstrates how the use of these medicines can be interpreted in terms of vulnerability and 'streetwise attempts to exercise agency' in reducing harm, p117). However, in casting these behaviours as 'misguided', the assumption of the primacy of medical scientific knowledge in how best to use these medicines is retained. Not all anthropologists have accepted this assumption, leading to critiques of the implicit dichotomy of biomedical knowledge as 'true' and local knowledge as 'belief'. As anthropologists increasingly recognised the complex set of beliefs embedded in biomedical science and practice itself, the proposal to 'convert' local populations to the 'correct' way of thinking became seen as problematic (Bibeau, 1997). Anthropologists have also questioned whether the focus on such beliefs, which may not relate to behaviours, is the reason why knowledge or education based programmes have often been unsuccessful in changing health practices (Yoder, 1997).

2.1.3. Structural influences

The early 1990s saw a shift in focus away from beliefs of individuals or local 'cultures' (the characterisation of which had come under scrutiny (see Clifford & Marcus, 1986)) and

anthropologists began more commonly to document wider social, political and economic structures affecting, amongst other things, access to medicines for infectious diseases. The inequalities shaping occurrence of disease as well as access to treatment were increasingly documented (Singer, 1990). The concept of 'structural violence' gained traction in anthropological analyses, referring to the injury caused by inequitable regulations and categories imposed upon people by structural systems or governing institutions (Galtung, 1969). Paul Farmer popularised the concept in relation to health (e.g. Farmer, 2005), and this has been influential in shifting responsibilities, for example for HIV treatment from citizens to states, with antiretroviral treatment becoming conceived as a human right. In many ways this underscored the centrality of medicines in development efforts and programmes such as the U.S. President's Emergency Plan for AIDS Relief (PEPFAR) and the Global Fund to Fight AIDS, Tuberculosis and Malaria, made the delivery of antiretrovirals, antibiotics and antimalarials the cornerstone of philanthropic aid. Despite this push to increase availability of these *essential* medicines, anthropologists have drawn attention to realities on the ground of continued disparities and interruptions in access to medicines through these programmes as well as through collateral damage to health systems of narrow interventions (Pfeiffer et al., 2008). Rather than addressing structural violence, it has been argued that these programmes reinforce these problems (Cameron, 2011). With regards to drug resistance, concerns around poor and marginalised groups as most vulnerable to infectious diseases carry over to those most vulnerable to resistant infectious. Farmer has proposed that the concept of structural violence is useful to understand both access and adherence to therapy (Farmer et al., 2006), which affects the development of resistance and ability to manage resistant cases. Furthermore, if access to medicines is to be restricted through efforts to halt resistance, then in many cases where access is already poor, this may exacerbate these problems. The impact on this in terms of cases and costs has been approximated (Mendelson et al., 2015) but the cost socially remains unexplored.

2.2. Antimicrobials as infrastructure

Anthropologists often ask, 'is this the only way things could be?' In the case of medicines, we can ask what would have happened without antibiotics, and what has been replaced or substituted by these medicines. Historical work has highlighted the role of hygiene in bringing about infection control. While antimicrobials are often understood to have enabled the reductions in infectious diseases that led to population explosion (Headrick, 1981), historians have also argued that it was infrastructure that played the major role (Illich, 1976). Illich argued that the provision of potable water and elimination of waste should be credited for the reduction in infectious disease, and moreover that the negative consequences of medicines which could inadvertently produce disease – iatrogenesis – were being overshadowed by this narrative of medical success. Whether or not antimicrobials have played the role ascribed to them in the histories of medical science of the 20th Century, the shared understanding of their integral role in creating and maintaining healthy populations should be taken seriously. This could be a fruitful field for further research and previous anthropology work could assist in conceptualising how antimicrobials have become integral to our understandings and practices of health, health care, global health and so on.

Anthropological concerns include material life. Studies of space and objects allow for analysis of objects, flows, systems and processes through which forms of life emerge and become taken-for-granted. For example, analysis of space in hospital wards, consulting rooms, or pharmaceutical outlets have revealed how relations, priorities, agendas and moralities are part of the use of medicines (Brown, 2011). A historical dimension is important here; an understanding of previous priorities, processes, resources and power relations is crucial for interpretation of the present (Giles-

Vernick & Webb). An example might be the dramatic increase in the number of beds on British medical wards with the founding of the National Health Service in the mid twentieth Century, when ‘the threats of cross-infection created by this increased turnover were again managed by antibiotics’ (Bud, 2006 p197). Similarly the use of antibiotics as prophylactic surgical treatment and for chemotherapy patients allowed for dramatic scale-up of surgery, chemotherapy and so on (Landecker, 2015). Thus, current ways in which we rely on antimicrobials as part of our infrastructure can be conceived as existent on top of previous practices, decisions and so on. Anthropological work that looks at layered landscapes of care could be instructive in this regard (see for example, Street, 2012). In this way, anthropology can help to uncover how antimicrobials have become a part of every-day life in ways beyond immediate curative health.

2.3. Antimicrobial ambiguities

As early as the 1950s there was substantial discussion over when antimicrobial use was appropriate, misuse or abuse, although without consensus, with physicians at the extremes of recommendations to restrict antibiotics to ‘emergency therapeutic crutches to be used only in seriously threatening conditions’ versus recommendations to use penicillin or a combination of antibiotics to treat flu or severe viral infections (Podolsky, 2015 p115 citing Arthur Lawrie Tatum and Henry Sweany respectively).

Concerns of over-use of antibiotics appear in some historic and anthropological analyses to be tolerated because of the apparent lack of choice for physicians. Even when a majority of antibiotic uses were classified as ‘irrational’, this critique could be countered with arguments of insufficient diagnostic testing (Podolsky, 2015). Unlike diagnostic tests, which can raise more uncertainty when negative, empirical treatment allows for both the possibility of the treatment to be effective and for time to improve the patient. It also prevents the situation of a worse outcome due to not treating. Anxiety over the potential consequences of missing a case requiring an antimicrobial have loomed large since these substances have been available for widespread use. Historian Robert Bud summarises accounts of doctors thus, ‘Whatever the probable diagnosis, were something to go unexpectedly awry then other people, and perhaps even they themselves, would ask why antibiotics had not been tried’ (Bud, 2007 p153). The genuine doubt over when antibiotics are required appears to be an ongoing issue. Anthropologists and sociologists have continued to document the triad of diagnostic uncertainty, demanding patients and the fear of untreated serious disease as central to prescribing practice through the decades since the 1950s (eg. (Cabral et al., 2015). Nonetheless, the notion of ‘rational therapeutics’ has persisted, with ‘a sceptical, as well as a moral, tone, to be juxtaposed to the influences of commerce, ignorance, or intellectual lassitude’ (Podolsky, 2015 p113).

The similar findings relating to the over-use of antimicrobials over time – and across different country settings – is notable. For example, the finding that it is perceived patient demand rather than direct patient preferences that drives prescribing has been found both amongst prescribers of antibiotics in the UK and in Peru (Britten & Ukoumunne, 1997; Cabral et al., 2015; Paredes et al., 1996) and of antimalarials in Tanzania and Cameroon (Chandler et al., 2008b; Chandler et al., 2010). Patients may in fact be more cautious about taking antimicrobials than clinicians presuppose. For a summary of scepticism about medicines, see Whyte et al. (2002, especially chapter 5). The fear of the consequences of missing severe infection has also appears to be a universal concern underlying antimicrobial ‘overuse’ (Cabral et al., 2015; Chandler et al., 2008a; Haak & Radyowijati, 2010), with

authors noting that the perceived risks (if any) of prescribing antimicrobials were far outweighed by the risks of leaving a potentially severe infection untreated (Paredes et al., 1996).

Some of the doubts expressed by prescribers and patients in anthropological studies of antimicrobial use have related to whether a standardised medical guideline on when and how much to use a particular drug applies in a given scenario. For example, in Cambodia, prescribers apply a principle of tailoring medicine combinations and dosages according to the capacity of the patient to respond to different types and strengths of medicines. Antibiotics may be mixed with antimalarials, steroids and other medicines in so-called 'cocktail' packets, which can be tailored through trial and error (Chandler et al., 2011). In Cameroon, as in other malaria endemic counties, patients have described how they know 'their' malaria, and take the 'right' drug for *them* which may differ from what is right for relatives and neighbours who have different bodily characteristics and responses (Chandler et al., 2010). In Europe, such tinkering with medicines also occurs (Mol, 2008) but may be less overt, in the context of the dominance of biomedical authority.

Thus, anthropologists draw attention to a paradox of the apparent simplicity of the mantra of 'right drug, at the right time, in the right dose', which implies a level of standardisation that could easily be implemented if following standardised guidelines, and the complexities of the realities of practice, which require other issues to be taken into account, with patients presenting off-text-book, and with additional needs not included in guidelines such as social, logistical, economic or clinical. This demonstrates that actors can at once affirm the principles of standardised practice whilst at the same time attending to context specific non-standard realities. One observation of how these ambiguities are managed is through an 'antibiotic culture', implying that for every ill-defined symptom, antibiotics are thought to offer a solution (Haak & Hardon, 1988). For more discussion on biomedical standardisation, see Lock & Nguyen (Lock & Nguyen, 2010). The need to fit clinical practice into standardised frames has been observed by anthropologists to become more accentuated in the context of working towards metrics (Biehl & Petryna, 2013), targets (including incentive-driven), within legal frameworks and in relation to evidence-based medicine (Kelly, 2008).

3. The charm of antimicrobials

Many anthropological studies have demonstrated the importance of considering pharmaceuticals as entities that operate beyond their curative properties. Even amongst biomedical scientists, these substances have an enigmatic air, for example in the way they are referenced as 'magic' bullets. The use of this term provides an invitation for anthropological analysis, given the way magic has been a central analytic in classical anthropology (see for example Evans-Prichard, 1937; Malinowski, 1948). In reference to antimicrobials, 'magic' evokes both the power and potential super-power of such substances and their relations to our material and social realities. Moving this further, anthropologists Sjaak van der Geest and Susan Reynolds Whyte have described medicines as having 'charm', providing a concrete solution to ill-health, and one that can be separated from a therapeutic encounter. This distinguishes medicines from other forms of healing such as surgery, which cannot be separated from a surgeon. Medicines are democratic and exoteric, they are 'widely believed to contain the power of healing in themselves. Anyone who gains access to them can apply their power' (Van der Geest & Whyte, 1989 p346). The same authors extended this perspective to incorporate a wide range of places and spaces where medicines flow, are exchanged as commodities, are prescribed and consumed. After Appadurai's *The Social Life of Things*, they invoke

an analytical framework of the 'Social Lives of Medicine', proposing that as *things*, medicines have biographies (Whyte et al., 2002). The authors trace these careers of medicines, often antimicrobial, and provide useful context for the ways in which these substances travel beyond the enclave of professional control and are made common. In drawing together a range of anthropological works, through which they illustrate how people in different settings, roles and industries, employ these substances for various endeavours, this volume is compelling in arguing that medicines should be understood beyond their capacity to cure (or poison).

The charm of pharmaceuticals, as concrete entities with wider symbolic, economic and political value, is a useful lens through which to consider how antimicrobial resistance may arise as well as how it may be tackled, especially in relation to the drivers of antimicrobial use. We can look at the value of antimicrobials for different actors in order to gain insights into the status quo, important to consider if intervention is to be undertaken, both to design effective interventions and to anticipate potential consequences beyond impact on AMR.

3.1. The charm of antimicrobials for patients

The anthropological literature on the use of antimicrobials by patients is vast. Some concepts that may be useful in considering the appeal of antimicrobials, even when their use is termed 'irrational' or 'inappropriate' for a particular case, are reviewed here including their symbolic value, their role in rituals of care, what has been termed the 'placebo' effect, and fourth the ability to tailor purchases according to affordability.

First, the concreteness of antimicrobials as a solution, helps to define the problem in a more concrete manner – it enhances the perception of illness as something tangible, which may be manipulated (Van der Geest & Whyte, 1989). This adds to the observation that a doctor's prescription serves a legitimising function, allowing an individual to take on a sick role (Parsons, 1951). A crucial distinction with this earlier theory, however, is that medicines can be detached from the professional encounter. In many settings they can be purchased. However, more than simple commodities, medicines (especially of the antimicrobial variety) carry built-in associations with knowledgeable doctors and with technological sophistication. Following ideas from classical anthropology about the symbolic value of apparently every-day goods, antimicrobials carry with them the characteristics of biomedicine as a broader system.

Second, leading from the semi-autonomous nature of these medicines, antimicrobials can be adapted and adopted within other medical systems, sold outside of medical settings, and used as self-medication. For example, capsules can be opened and sprinkled on wounds; tablets can be mixed with others into 'cocktails', and can form part of a process of care involving other traditions and rituals (Haak & Hardon, 1988; Whyte, 1992). Self-medication has been a fascination of the public health research community, assumed to be undesirable as consumers are believed not to have correct knowledge (Haak & Radyowijati, 2010). For useful reviews of the ways in which antimicrobial use has been studied in the informal sector, including lay networks, medicine sellers, pharmacies and so on, please see Whyte et al. (2002) and Haak & Radyowijati (2010).

Third, the experienced effects of a drug may not align with biomedical expectations of its active ingredients; an 'inert' pill may have a positive impact on the patient. This has been termed a placebo (literally, I shall please) effect. Anthropologists have studied this as part of the human healing process, in which the pill has become a symbol carrying meaning within particular events, relationships and histories. For more discussion of the placebo effect, see Moerman (2000) and

Whyte et al (Whyte et al., 2002). The confidence and expectation built into a pill, which reflects a wider set of relations and experiences, is enacted in a biomedical encounter with some self-awareness on behalf of both prescribers and patients. In Cameroon, clinicians openly recognised that they were providing ‘psychological treatment’ to patients in the form of pills, as well as diagnostics (Chandler et al., 2012). The authority and power of such biomedical commodities appears an important part of such processes of healing.

Fourth, medicines are appealing for economic reasons. These include the possibility to start and stop treatment at will, including to save or share drugs; to purchase the amount that can be afforded (van der Geest, 1987) and also the anticipation that by taking these medicines one can return to work rather than requiring time to recover (Chandler et al., 2011; Vuckovic, 1999). Each of these issues is important to consider in scenarios where medicines require out-of-pocket-payments and where day-wage labour is common.

Because of these different charms of medicines, they may be integrated into multiple forms of healing. There is a vast anthropological literature on medical pluralism – where multiple systems of healing are seen to exist as alternative or inter-related systems where patients access care. This work is informative in contextualising access to antimicrobials, which may be sourced in small shops, by a range of healers, in market places, pharmacies, private and public biomedical practitioners. In heterogeneous health sectors, patients may easily switch between providers depending upon the success with one or the other during a particular episode, called ‘medical syncretism’.

In sum, patients can be seen through anthropological studies as experts on how to elicit and accomplish the healing that they regard will be most likely to ‘work’ for them. ‘Just as men and women infrequently behave as the rational, economic actors envisioned by health planners and policymakers, what they know to be true about health, illness, disease and medicine is often not what biomedical clinicians want them to know’ (Foley, 2010 p6).

3.2. The charm of antimicrobials for different types of providers

Research into the rational use of medicines has identified that prescriber ‘irrational’ use of antimicrobials is at least in part due to matters beyond the perceived medical suitability of a particular drug for a particular patient. A range of influences on prescribers have been described (summarised below). With the shift in dominant political economic thought in the UK from the assumption of medical practitioners as altruistic public servants to self-interested employees, and from patients as members of the public as recipients to consumers, different models surfaced for interpreting and changing health care practice (Le Grand, 2006). The autonomous model of medical practice was recast as incentive-driven, to be handled through competition and accountability measures. Medical sociologist and clinician David Armstrong wrote in the wake of this transition that, ‘Doctors will have to learn that a satisfied patient is as important as a medically improved one’ (1990 p693). This way of thinking about prescribers sits neatly with investigations into medicine use in low and middle income settings that are dominated by informal providers, many of whom had taken on antimicrobials within their varied practices. As anthropological documentation of the every-day practices of these informal providers and their clients has emerged (such as van der Geest, 1982, 1987), such reports have opened up for investigation and intervention a wide range of locations in which antimicrobials were being traded and consumed (Whyte et al., 2002).

Anthropologists have set out and considered different frameworks for characterising different sectors through which patients could access pharmaceuticals. First was Arthur Kleinman’s

professional, folk and popular sectors model in which different social relations as well as clinical realities were key characteristics (Kleinman, 1980). Whyte and colleagues draw attention to drug shops as a common feature in many health systems but which fits uneasily into this model. They highlight that a key characteristic of such sources of medicines is that 'going to a drugstore to seek health care allows one to retain more control while still taking advantage of the knowledgeability of the retailer, whether certified pharmacist or experienced drugstore attendant.' (2002 p100). Cross & MacGregor (2010) problematize the distinct-sectors model further in their examinations of the way informal providers are portrayed in global health literature. They highlight the ways in which descriptions such as 'irrational' are 'deeply entwined with prejudices and pre-conceptions based on hierarchies of caste, class, gender or ethnicity' (p1595). They expand, 'the portrait of irrational village practitioners and their fatalistic rural patients also marks a social hierarchy between agents of development and the people they target, so that lay knowledge or practice comes to be defined by and against the rational, educated, elite cosmopolitan'. These practitioners then, can be seen as 'those against whom the educated and rational self is defined' (Pinto, 2004).

Anthropological research, then, has attempted to situate medicines as they are prescribed, sold, traded within local networks of relations embedded in particular histories, legacies and political economies. Some of this research has been directly incorporated into debates around rational use of medicines, for example the inclusion of anthropological work at the two international conferences for 'Rational Use of Drugs', in 1997 and 2004, both held in Chiang Mai, Thailand. A summary of the presentations of the 1997 conference is provided in the WHO's Essential Drugs Monitor (see <http://apps.who.int/medicinedocs/documents/s16422e/s16422e.pdf>) and again for the 2004 conference (see <http://apps.who.int/medicinedocs/documents/s14078e/s14078e.pdf>). The work on rational drug use led by the WHO also included anthropologists, who developed two manuals relating to investigating and promoting rational use of medicines by consumers (Chetley et al., 2007; Hardon et al., 2004). This work was based on the international Promoting Rational Drug Use in the Community (PRDUC) programme in Thailand, Uganda and South Africa which ran from 2000 onwards, as well as a longstanding programme of research in many different countries led by the Anthropology Department at the University of Copenhagen.

This body of research and its legacy allow us to see medicines as a central symbol of biomedical and other forms of care provision. The concrete nature of medicines, or in their stead a medical prescription, is seen as crucial to their charm for providers as much as for patients. Providing a medicine, or prescription, allows the person being consulted to 'do' something for the patient (Pellegrino 1976). This alleviates uncertainty and ambiguity around the complaint or what to do about it. This can be seen as beneficial for the prescriber as well as the patient, as they are able to terminate the consultation feeling satisfied that they have met the patient's needs (Sachs, 1989). Moreover, the medicine or prescription provides a symbol that concern has been elicited from the person consulted. When this person is part of an authoritative medical profession, this token can be seen to lend legitimacy to the patient's illness (Parsons, 1951). The culmination of medical interactions in a concrete medicine or prescription has been described in many settings to be the desired outcome, creating the ideal conditions for recovery (Whyte et al., 2002). Thus, anthropological studies have revealed the ritual elements of consultations that providers employ with their clients or patients, with medicines as a closing ritual. Such work provides insights into why it may be simpler for health care providers to switch from one medicine to another than to prescribe no medicines (for examples of drug switching, see Hopkins et al REF where antimalarials were substituted with antibiotics in the face of negative test results across numerous settings).

The need to provide a 'strong' medicine, such as an antimicrobial, rather than a 'simple' medicine such as paracetamol has been contextualised in anthropological studies by the importance for prescribers of maintaining status as a gatekeeper for biomedicine. For medical professionals, their authority can be maintained by their ability to write prescriptions and provide access to medicines patients are 'not supposed' to obtain from others (Whyte et al., 2002). It may also relate to the 'placebo' effect described above, whereby faith of both the practitioner and the client in the medicine can result in an improvement in outcome even if the medicine does not contain the properties biologically required (Moerman, 2000). Thus, even if guidelines suggest a particular management of for example diarrhoea with oral rehydration solution (ORS), there may be numerous reasons why antimicrobial treatment is instead or additionally provided, including the devalued status of ORS by comparison (Howteerakul et al., 2003).

The reasons that medicines or prescribing has become the desired outcome are also of interest to anthropologists. Historically, antibiotics enabled a new basis for authority of physicians, and became woven into the consultation process. With time pressures and high patient numbers, antibiotics often replaced the time that a patient may have once received from a doctor. Pressured doctors could speed up throughput by writing antibiotic prescriptions (Bud, 2007). Another reason anthropologists have described for consultations culminating in medicines or a prescription is as a way of dealing with uncertainty and emotional concern; 'prescription fits the impulse of modern man to control his own destiny, to take the problem in hand and conquer it with technology' (Pellegrino, 1976 p626). Here, we can see how the matter of medicines use or prescription, moves well beyond the biological needs for a particular drug in a particular case. It has become an expected part of the clinical encounter, embedded in the rituals of providing care, as well as a technological solution during health encounters where there is limited time to provide care for each individual patient.

3.3. Antimicrobials as industry

Medicines of different sorts have price-tags, and have been shown to constitute important income for sellers and prescribers. Patients may be happier to pay for a drug than a consultation. Other financial incentives may operate to influence the types of prescribing a pharmacist or clinician undertakes. Choice of medicines by providers as well as patients is subject to marketing, and therefore linked to wider flows of money, and industry.

Anthropologists have become increasingly interested in the ways that particular medicines are developed, tested, promoted, circulated in different scenarios. Readers are referred to Lezaun & Montgomery (2015), Petryna (2009), Biehl (2006) and Ecks (2013). Such work is relevant to the broader context within which debates around antimicrobial resistance and the need for new pharmaceuticals are taking place.

3.4. The charm of antimicrobials in national and global arenas

Anthropologists have studied the ways in which medicines, primarily antimicrobials, have taken centre stage in the enactment of the global health movement (see for example, Samsky, 2015). Access to medicines has been a policy priority for decades in various incarnations, including in the latest agenda of Universal Health Coverage (Clark, 2014). The possibility of saving enormous quantities of lives through the delivery of antimicrobial medicines is an attractive prospect. Philanthropic individuals have become increasingly involved in donating wealth to improve lives in

less wealthy settings, channelled through commodities primarily in the form of medicines. In line with dominant neoliberalist frameworks, these donations have brought with them particular wisdom: modes of thinking and operation that have been productive in the business world. For an enlightening review of how the Rockefeller Foundation and subsequently Gates Foundation leveraged their influence over health policy in the case of malaria control, narrowing the focus of policy to commodities and framing donations as ‘investments’, see Eckl (2014). Of Bill Gates’ fourteen ‘Grand Challenges in Global Health’ announced in 2003, nine relate directly to improving access to novel or existing pharmaceutical technologies. The involvement of such philanthocapitalism has been traced by anthropologists to contribute to a repurposing of the essential medicines concept, with new roles of NGOs and philanthropies as well as creating new roles for pharmaceutical corporations in the new structures of global health (Greene, 2015).

The increased reliance on pharmaceuticals to deliver global health, or *pharmaceuticalization* of global health, has developed with a concurrent move away from labour-intensive traditional public health prevention (Biehl, 2006). Such a strategy appears cheaper and more efficient for governments (Biehl, 2006; Whitmarsh, 2008). This shift towards pharmaceuticalization has been cast as ironic in the context of drug-resistant strains of diseases (Bell & Figert, 2015) under which conditions patients would have access to ineffective medicines for potentially preventable conditions.

In global health, mass drug administration also continues to hold appeal, as a method by which to prevent and/or treat a large population, some of whom would otherwise suffer with a particular disease. Antimicrobials are often the drug of choice for example azithromycin for trachoma. Anthropological work has read these programmes as intentionally context-free and apolitical but practicably ridden with challenges and politics (Parker & Allen, 2014; Samsky, 2015). This research again illustrates the appeal of apparently pathogen-focused strategies that in practice become ‘peopled’, and opened up to questioning by so-called recipients who ask what strings are attached. These questions are accentuated in a context of initiatives to communicate the imperative to restrict antimicrobials due to resistance.

4. The underbelly of anti-microbial resistance

4.1. Microbes and multi-species relations

Anthropological work has begun to contribute to how we understand changes and movement of microbes and their relations with humans and nonhumans (e.g. livestock). Classical anthropology sought to characterise all aspects of particular societies, which focused not only human kin relations, rituals and beliefs but encompassed relations with other species, incorporating rich descriptions of every-day life from sleeping arrangements to toilet practices, to food production and social gatherings (see for example Evans-Prichard, 1937). However, these engagements tended to read animals as sources of food and medicines, in myth and as symbols. Over the past decades, the focus of anthropology has further broadened to include the study of the lives of other species (e.g. mammals, insects, fungi and microbes), their conceptual and material relations with humans and the ways that economic, political and cultural processes shape them. This shift in focus has been referred to as the ‘species turn,’ indicating a growing number of anthropologists’ attempts to go beyond humans and take the lives of other species seriously. In this sense, it has become a sub anthropological genre in its own right, and is broadly grouped under the term multi-species

ethnography (see for example S. E. Kirksey & Helmreich, 2010 and others in the same Cultural Anthropology special issue for some discussion of its emergence and examples of relevant texts).

Donna Haraway's work with and on dogs as 'companion species' offers a key starting point for understanding how the power of a multi-species approach troubles questions of human exceptionalism, agency and the nature/culture dichotomy (Haraway, 2008). Her focus on the co-existence of humans and dogs through processes of domestication, co-evolution and training amongst many others, shows how these processes have (and continue to) shape and transform not only dogs, but also their owners, as well as the way they coproduce niches and ecologies (Haraway, 2008; S. E. Kirksey & Helmreich, 2010). Donna Haraway, as well as Anna Tsing's recent work on Matsutake mushrooms (Tsing, 2015), demonstrates what Kirksey (2014) identifies as an important aspect of much multispecies work, which is a focus on what it means for humans to live with other species rather than grappling with difficult question of how to speak for and with other species. In addition, such a focus also benefits from examining, 'Who benefits, when species meet?' (S. E. Kirksey & Helmreich, 2010). Multispecies work has also extended to human microbial relations, which may be of special interest to work on Antimicrobial resistance (see for example Heather Paxson's (2012) work on cheese production and pasteurisation or Cecilia Lowe's (2010) work on influenza virus in Indonesia). Drawing on the multispecies literature and some of the concepts it offers, may provide fruitful avenues for studying the many ways that antimicrobial resistance comes into being, is spread and the multiple species that may be involved in these processes.

Here, anthropologists employ concepts in common with scholars of science and technology, "the earthy and muddled and tenacious engagements afforded by 'ecologies', 'infrastructures' and 'entanglements' have brought new sources of analytical vitality and valence to social theory. These are languages of description that conjure worlds of material and biotic interdependencies, human and non-human agencies weaving themselves into and around filaments of energy, matter, history and decay" (Jimenez, Forthcoming).

4.2. Governing Microbes

Anthropological research is rarely found in discussions of global governance and the creation of global health policy. Recent shifts in both, however, have enabled space for ethnographic concern with practice and power to add a new dimension to often idealised accounts or parsimonious models of governance and policy change. For analyses of AMR, these anthropological approaches could enable rich findings on processes of interpretation, translation, the creation of consensus and the building of interpretive communities that are expected to underpin effective collective action (see for example Mosse, 2005; Muller, 2013). As Muller argues, the anthropology of global governance should enable a fine-grained analysis of the formal and informal mechanisms of governance that emerge as relatively powerless and underfunded organisations tackle the essential issues of our time (Muller, 2013). Fundamental to these anthropological approaches to global governance is the critique of the idea that there is a stable policy problem that sits at the heart of the debates at global level. Anthropologists should be able to identify the ways in which AMR as a policy object or problem is a 'moving target' (Hacking 2007 in Storeng, 2014), shifting its identity in accordance with the ideological positions of the actors involved.

5. Conclusion

This paper aimed to set out some of the ways in which different anthropological work could be brought to bear on antimicrobial resistance. The largest body of relevant research relates to the reasons why medicines are so popular, and why it may be difficult to reduce their use in the face of AMR imperatives. Smaller, but growing, bodies of research challenge common assumptions in the ways we think about microbes and our lives with them; and also the ways scientific concepts are taken up and shaped through policy processes. Each of these fields are highly relevant to considering AMR today. There is great potential for interdisciplinary work within AMR, and anthropologists are well placed to engage in such endeavours drawing on the history of the discipline in understanding medicines uses, social and political processes of pharmaceuticalisation and relations between species, science and policy.

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